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**The Impact of Financial Liberalization on Bank Efficiency:
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The Impact of Financial Liberalization on Bank Efficiency:
Evidence from Latin America and Asia

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Abstract

This paper investigates the impact of financial liberalization on bank efficiency, using data for a sample of over 4,000 bank-year observations from ten emerging economies for the period 1991-2000. We use Data Envelop Analysis (DEA) to calculate bank efficiency at the individual bank level. Bank efficiency measures are then aggregated at the country level to investigate the relationship between financial liberalization and bank efficiency, using a panel least square fixed-effects model. Overall, we find strong support for the positive impact of financial liberalization programmes on bank efficiency.

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1. INTRODUCTION

Over the last two decades, many emerging economies have implemented financial liberalization policies. These policies aim at enhancing competition, improving resource allocation, and acquiring more efficient financial institutions, by making them less state-directed and by exposing them to increased market competition (Barajas and Steiner, 2000). The question, however, is whether these policies have indeed been successful in achieving these results.

Only a few studies have looked into the efficiency effects of financial liberalization policies in emerging economies. The available evidence provides mixed results on the relationship between bank efficiency and financial liberalization. These mixed results may be due to various reasons, of which we mention two here. First, most available studies focus on just one country, leaving open the possibility that in one country bank efficiency improves after liberalization, while in another country the opposite is found. Country-specific studies, therefore, may make it more difficult to come up with general conclusions regarding the impact of financial liberalization on bank efficiency. Second, most studies focus on just one or a few dimensions of financial liberalization.

This study aims at improving on the previous empirical literature by using a multi-country sample. Moreover, we use a unique dataset, provided by Laeven (2003), which includes different dimensions of financial liberalization policies. Based on this dataset we are able to measure the depth of financial liberalization at the country level and link changes in the depth of financial liberalization to changes in bank efficiency over time.

Our dataset consists of more than 4,000 bank-year observations for ten emerging economies in Latin America and Asia, i.e. Argentina, Brazil, Peru, Mexico, India,

Indonesia, Korea, Pakistan, Philippines and Thailand. The countries in our sample have implemented substantial financial liberalization policies during the 1990s. The period of investigation is from 1991 to 2000. The efficiency of banks is measured by using Data Envelopment Analysis (DEA). The resulting efficiency scores per bank are aggregated at the country level and are then related to the financial liberalization measure at the country level.

The paper is organized as follows. Section 2 reviews the previous literature on the relationship between financial liberalization and bank efficiency. Section 3 explains the methodology we have used to measure bank efficiency. In section 4 we discuss the data and the variable selection. Thereafter, the results of the empirical analysis into the relationship between bank efficiency and financial liberalization are presented and discussed in section 5. The paper ends with a conclusion and recommendations for further research in section 6.

2. FINANCIAL LIBERALIZATION AND BANK EFFICIENCY: A BRIEF LITERATURE REVIEW

Since the 1990s, financial liberalization policies have been implemented widely in developing and emerging economies.¹ They have become a major component of the Washington consensus and have been part of many IMF and World Bank reform programmes. Financial liberalization programmes aim at eliminating government control and intervention in the financial system of an economy. Such financial repression policies adversely affect the efficiency with which banks and other financial institutions are able to intermediate funds from savers to investors (McKinnon, 1973;

¹ During the 1970s and 1980s, countries have also experimented with financial liberalization policies. Especially during the 1970s, countries such as Argentina, Chile and Uruguay implemented financial liberalization. However, the wave of financial liberalization policies was most apparent from the early 1990s.

Shaw, 1973), since these policies severely interfere with the price mechanism and with competition.

Until the late 1980s, financial repression policies were responsible for the poor operations of banks in most developing and emerging economies. In many of these economies the banking industry was heavily controlled by the government. In particular, banks – many of which were directly owned by the state – were obliged to allocate part of their total loan portfolio to specific sectors. Moreover, the government determined the interest rates on deposits and loans. It also regulated the licensing of market entry of new domestic and foreign banks, and controlled the establishment of new bank branches. Finally, it put restrictions on foreign financial transactions (Kumbhakar and Sarkar, 2003, Isik and Hassan, 2003).

In such an environment, banks had little motivation to improve their performance by reducing operating costs, increasing the mobilization of deposits and improving the efficient allocation of loans. From the late 1980s, policy makers in developing economies became aware of the importance of the financial system and the process of financial intermediation for economic growth (World Bank, 1989; King and Levine, 1993). To improve the process of financial intermediation these governments therefore implemented financial liberalization policies aimed at improving the efficiency and productivity of the banking system.

In theory, financial liberalization is expected to improve bank efficiency (Berger and Humphrey, 1997). The elimination of government control and intervention aims at restoring and strengthening the price mechanism, as well as improving the conditions for market competition (Hermes and Lensink, 2008). This, it is argued, will

lead to more efficient allocation of scarce financial resources.² Competitive pressure stimulates banks to become more efficient by reducing overhead costs, improving on overall bank management, improving risk management, and offering new financial instruments and services (Denizer *et al.*, 2000). Moreover, if domestic financial markets are opened up to foreign competition, this will further increase pressures to reduce costs, whereas at the same time, new banking and risk management techniques, as well as of new financial instruments and services may be imported (Claessens *et al.*, 2001).

Although theory predicts improvements of the efficiency of banks in terms of their financial intermediation activities resulting from financial liberalization policies, there is a lack of empirical studies on this issue in the context of developing and emerging economies. Moreover, the few empirical studies investigating this relationship provide mixed results. Below, we review the empirical research focussing on a number of emerging economies.

Gilbert and Wilson (1998) analyse changes in technical efficiency and changes in technology of Korean banks during 1980-1994. They find that the bank reforms the Korean government established in 1991 improve productivity and potential output of Korean banks. Yet, Hao *et al.* (2001), using data for the period 1985-1995, conclude that there is little or no positive relationship between the reforms and efficiency of Korean banks.

Isik and Hassan (2003) analyze changes in total factor productivity of Turkish banks due to financial market deregulation in the period 1981-1990. Their results indicate that Turkish banks improve their performance considerably after the

² Note that financial liberalization may also have quantity effects, i.e. it increases the amount of resources that are intermediated between savers and investors. By introducing market principles and competition in financial markets interest rates on deposits be raised, leading to higher saving and investment rates. This is not the focus of this paper, however.

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3 implementation of financial liberalization. However, Denizer *et al.* (2007), who also
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5 examine Turkish banking efficiency, using data before and after the liberalization in
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7 the period 1970-1994, find that bank efficiency has actually declined after the
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9 liberalization programs was carried out.
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13 Kumbhakar and Lozano-Vivas (2001) analyze the impact of deregulation on
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15 the performance of Spanish savings banks. Using data for the period 1986-1995, they
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17 conclude that regulatory reforms lead to slightly better banking performance. In
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19 particular, they find evidence that despite declining technical efficiency, the
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21 productivity growth rate increases in the post-liberalization period. Using data for
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23 1985-1996, Maudos *et al.* (2002) conclude that cost efficiency of Spanish banks
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25 improved due to a more competitive environment. In contrast, Grifell-Tatje and Lovell
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27 (1996) examine productive efficiency of Spanish savings banks during the period
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29 1986-1991. Their research suggests that the deregulation programs were followed by a
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31 decline in productivity of banks.
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37 Bhattacharyya *et al.* (1997) investigate the performance of Indian banks during
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39 the early period financial liberalization (1986-1991). During this period the Indian
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41 government gradually introduced economic deregulation measures. Their results
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43 indicate that throughout the whole period state-owned banks operate the most
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45 efficiently, whereas private banks are the least efficient. Interestingly, foreign-owned
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47 banks do not perform well at the beginning of the period but later on their performance
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49 improves, reaching levels close to those of the state-owned banks. Ataullah *et al.*
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51 (2004) find evidence that financial deregulation has a positive impact on bank
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53 efficiency in both India and Pakistan. Using data for the period 1988-1998, they show
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55 that overall technical efficiency of the banking sector increases following financial
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57 liberalization, especially after 1995-1996. Ataullah and Le (2006) focus on India and
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the impact of a broader set of reforms (i.e. financial reforms, fiscal reforms and private investment liberalization) and find that efficiency of banks increased due to increased competition. Hardy and Patti (2001) investigate the effects of financial reforms on profitability, cost and revenue efficiency of the banking sector in Pakistan banks during 1981-1998. They show that financial liberalization has a positive impact on banking sector performance. In particular, cost and revenue efficiency of banks increases, following financial liberalization policies. Patti *et al.* (2005) examine cost and profit efficiency of financial liberalization in Pakistan, using data for 1981-2002. They find that financial liberalization leads to increased bank profits in the first round of financial reform during 1991-1992. However, in subsequent years reforms do not have a positive impact on bank performance. Actually, their study shows that profitability declines after 1997. According to the authors, this is mainly due to deteriorating business conditions.

Williams and Nguyen (2005) is one of the few studies that analyse the relationship between financial liberalization and bank efficiency in a multi-country setting. This paper considers the impact of financial liberalization on bank performance in Indonesia, Korea, Malaysia, the Philippines and Thailand during the period 1990-2003. In particular, they investigate the empirical relationship between profit efficiency, technical change, productivity and commercial bank ownership. Their findings suggest that privatization policies encourage improving bank efficiency and productivity.

The above discussion of existing empirical studies suggests that the impact of financial liberalization on bank efficiency remains unclear: the impact may be either positive or negative. This means that the relationship between the two remains an empirical issue. In this paper, we add to the empirical literature on this issue in the

following way. In reviewing existing empirical evidence, we first of all observe that most studies look at country cases. We suggest that country-specific studies may make it more difficult to come up with general conclusions regarding the impact of financial liberalization on bank efficiency, which is why in this paper we intend to take a multi-country approach. Secondly, the review shows that in most, if not all previous papers financial liberalization as such is not really quantified. Several of these papers focus on a specific period during which bank reform policies have taken place and analyze whether during this period measures of bank efficiency change. Moreover, several papers just look at one or a few dimensions of financial liberalization, such as interest rate liberalization or privatization of state banks.

Yet, in theory, at least, the extent to which financial markets are liberalized may be linked to the impact of these liberalizations on bank efficiency. In particular, the more the government retreats from influencing the allocation of scarce financial resources, the more the price mechanism will be restored and the more the conditions for market competition will be improved, which is expected to result in more efficient banking activities.

In our analysis, we explicitly take into account what we call the depth of financial liberalization policies and their effect on bank efficiency. By this we mean on how many different dimensions the government of a country has substantially liberalized markets. Based on a unique dataset provided by Laeven (2003), we are able to measure the depth of financial liberalization and link changes in this measure to changes in bank efficiency over time. The exact nature of the liberalization data and how we have used them in the analysis will be discussed in more detail in section 4.

3. MEASURING BANK EFFICIENCY

In the literature on bank efficiency various approaches have been used to measure efficiency. Basically, these approaches come down to estimating a specific form of the so-called best practice frontier such as the (maximum) production frontier, the (minimum) cost frontier, or the (maximum) profit frontier. The efficiency level of an individual bank is then defined as the distance of this individual bank's production, costs, or profits to the frontier. Discussions on the measurement of efficiency have been inspired by the work of Debreu (1951), Koopmans (1951) and Farrell (1957). Coelli *et al.* (1999) provide a comprehensive overview of the measurement of efficiency and productivity.

In this paper, we focus on measuring so-called technical efficiency. A bank is considered to be technically efficient if it produces optimal quantities of output given the amount of inputs, or alternatively, if it produces given amounts of output with minimum quantities of inputs. This also means that when measuring efficiency, we focus on production, instead of costs or profits. This choice is driven by data availability: data on input prices and/or profits of banking services are more difficult to obtain as compared to data on production of these services.

Technically efficient banks operate on the best practice production frontier, whereas technically inefficient banks perform below this frontier. Put differently, technical efficiency is measured as the difference between the observed output-to-input ratio of a bank and the same ratio achieved by those banks operating on the production frontier.

There are several methods to estimate the efficiency frontier. In general, these techniques can be divided into parametric and non-parametric approaches (Kumbhakar and Lovell, 2000; Berger and Humphrey, 1997). The nonparametric and parametric

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3 methods differ in several ways such as with respect to their behavioural assumptions
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5 and whether or not they recognize random errors in the data (noise). Parametric
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7 methods require specifying a particular functional form which shapes the form of the
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9 frontier. The measure of efficiency may be biased due to specification errors if the
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11 functional form is misspecified. In contrast, nonparametric methods do not require
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13 specifying the functional form for the frontier. They allow for the possibility that if
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15 random errors exist, these errors may influence the shape and position of the frontier.
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17 Therefore, parametric approaches take into account random errors when specifying the
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19 frontier. Parametric approaches are likely to be more appropriate when the data are
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21 heavily influenced by random errors. However, when random errors are considered to
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23 be less, a firm's output is multi-dimensional, and/or prices are difficult to obtain, non-
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25 parametric methods may be the optimal choice. Therefore, the selection of the
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27 appropriate method should be made case-by-case (Coelli *et al.*, 1999).
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34 Following a number of other studies in the bank efficiency literature, e.g.,
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36 among others, Aly and Grabowski (1990), Ferrier and Lovell (1990), Berg *et al.*
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38 (1993), Wheelock and Wilson (1995), Bhattacharyya *et al.* (1997), Isik and Hassan
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40 (2003) and Denizer *et al.* (2007), we use the Data Envelopment Analysis (DEA) to
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42 calculate technical efficiency of banks. DEA uses linear programming methods to
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44 construct a nonparametric piece-wise surface (or frontier) over the selected sample of
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46 banks based upon measures of bank output. Efficiency of a bank is measured as the
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48 distance from each individual bank's output to this surface.
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53 We use two versions of the DEA model. The first model assumes constant
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55 returns to scale and is focused on minimizing inputs for a given level of output (i.e. the
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57 input-orientated version of DEA). The efficiency measure derived from the model
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59 reflects the overall technical efficiency (*OTE*). Assuming constant returns to scale is
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only appropriate when all banks are operating at the optimal scale. Yet, if this is the case, the size of banks is not the appropriate measure to scale in order to analyse relative efficiency among different banks, since it is assumed that all banks, small and large, are able to produce with the same input-output ratios, i.e. there are no (dis)economies of scale. To account for scale effects, we use a second version of the DEA model as proposed by Banker *et al.* (1984), which explicitly allows for variable returns to scale. Calculation of efficiency based upon this method leads to a decomposition of *OTE* into scale (*SE*) and pure technical efficiency (*PTE*) components. Scale efficiency can be interpreted as the proportional reduction of input use to be obtained if the bank operates at the optimal scale (constant returns to scale). *PTE* refers to the bank's managerial and marketing skills in using its inputs in order to maximize outputs. This relates to skills such as controlling operating expenses, effective screening and monitoring of borrowers, marketing activities focussing on attracting depositors, efficient risk management techniques, etc. To conclude, *OTE* is determined by economies of scale due to the size of the bank (*SE*) and managerial efficiency (*PTE*).

In order to be able to calculate efficiency, we need to select input and output measures of bank activities. In the literature five common approaches are used: the production approach, the intermediation approach, the asset approach, the user-cost approach and the value added approach. Of these five approaches the production approach and the value added approach are the most widely used (e.g., by Ferrier and Lovell, 1990; Aly and Grabowski, 1990; Berger and Humphrey, 1991; and Hunter and Timme, 1995).

According to the production approach, banks produce services to depositors and borrowers. The approach uses traditional production factors such as land, capital and

labour as inputs to produce outputs specified by the number of accounts serviced and/or transactions processed. According to the intermediation approach, banks are intermediaries, transforming and transferring financial resources they borrow from depositors into the credit lent to borrowers. This approach uses deposits collected and funds borrowed from financial markets (i.e. bank liabilities) as inputs, whereas loans and other assets are considered to be the bank's outputs. One limitation of this approach is that it may not consider all activities provided by banks, e.g. intermediation of corporate and government bonds, investment banking activities, underwriting activities, etc. (Favero and Papi, 1995).

This paper uses a combination of the production and intermediation approach. Due to data availability, this paper only uses measures of labour, physical capital and loanable funds as inputs. Labour is measured by personnel expenses. Physical capital is measured by the total book value of fixed assets, other earning assets and non-earning assets. Loanable funds include time and savings deposits, commercial deposits, bank deposits and certificates of deposits. Moreover, we use two output measures, i.e. total demand deposits and total net loans. Net loans are defined as total loans net of loan loss reserves.³

³ One of our referees pointed out that there may be a quality dimension of loans that is unmeasured in this study, and more generally in the literature on bank efficiency and financial liberalization. The quality dimension refers to the fact that before liberalization, many loans may require low screening and monitoring due to government involvement and may thus be low-quality loans, whereas after liberalization loan decisions are taken by banks that put in screening and monitoring efforts, potentially leading to higher quality loans. Thus, a simple ratio of quality-unadjusted loans to inputs may be a poor measure of efficiency. Although we agree with the referee on this point, we would also like to stress that it is very difficult to come up with better measures of efficiency, which take into account such quality adjustments. Based on the available data, we were not able to produce better measures, which is why we have used a crude measure like loans to inputs, a measure that has been used also in several other studies in this literature.

4. DATA AND RESEARCH METHODOLOGY

First of all, we explain how we have constructed our measure of financial liberalization. For this we use a financial liberalization index that has been developed by Laeven (2003). This index shows the extent to which a country has implemented financial liberalization policies in six different areas in a particular year. These six areas are interest rates, entry barriers, reserve requirements, credit controls, privatization and prudential regulation. For each year and for each policy area Laeven (2003) has evaluated whether there has been significant progress in taking liberalization measures. For each of the six policy areas a dummy is created, which is 0 when no significant progress has been in made in a particular year; it is 1 when there has been significant progress. The financial liberalization index for a particular year is the sum of the six dummy variables in that year. Thus, the index ranges from 0 to 6. The index can be seen as a measure of the depth of financial liberalization implemented by the government of a country: the higher the index, the higher the number of policy areas for which the government has carried out significant liberalizations. Table 1 provides an overview of the financial liberalization index for the ten countries over the period 1991-1998, the period for which the data on the index are available.

<Insert Table 1 here>

For our analysis we transform the data for the financial liberalization index into a dummy variable (*LIBER*) that takes a value of 0 if the index is 0, 1, 2, 3 or 4 and is 1 if the index is 5 or 6. We interpret a 0 as a situation of low or medium-level liberalization; a 1 is interpreted as a situation of high-level or full liberalization. Note

that our data on bank efficiency run until 2000, so for 1999-2000 we have no data on the financial liberalization index. However, as Table 1 shows, in 1998 for all ten countries in our sample the index was 5 or 6, meaning that *LIBER* gets a 1 in all cases. We assume that for 1999-2000 financial liberalization efforts in the ten countries are not reversed from high or full to lower levels of financial liberalization, i.e. we assume that *LIBER* remains to be 1 during these two years.⁴

The data with respect to bank activities to measure bank efficiency are taken from financial statements of banks provided by BankScope (CD-ROM version 1999 and 2002). The data base used in the analysis covers information from ten emerging economies in Asia and Latin America, i.e. Argentina, Brazil, India, Indonesia, Korea, Mexico, Pakistan, Peru, the Philippines and Thailand, for the period 1991 to 2000.⁵ Data availability does not allow us to go back further. Tables 2 and 3 provide information on the data coverage for each of the ten countries in terms of the number of banks in the data set and their share in the total assets of the domestic banking system for each year. Table 3 shows that the coverage in terms of the share of total assets is substantial for most countries in most years. The only exception is Indonesia, for which the share fluctuates between 23 and 80 per cent. We have an unbalanced panel data set, since for several banks data are missing or not available for the entire 1991-2000 period. In order to be taken into account in our analysis, a bank must have at least three years observations. As discussed in section 3, we have three different measures of bank efficiency: *OTE*, *PTE* and *SE*.

<Insert Table 2 here>

⁴ The data in Table 1 show that the financial liberalization index does not reverse for any of the countries in any of the years.

<Insert Table 3 here>

We calculate bank efficiency scores at the individual bank level, using the three different efficiency measures, and then aggregate annual average efficiency scores of all banks at the country level. We use separate annual frontiers for each country (which in the literature is known as the national frontier) to calculate efficiency scores, rather than one common frontier for all countries. Both the common frontier and the national frontier have been used in the literature. The common frontier approach assumes the same technology among countries; it does not capture cross-country differences. The national frontier approach does not follow this assumption (Coelli *et al.*, 1999; Berger and Humphrey, 1997).

Tables 4A (reporting on the Latin American countries) and 4B (referring to Asian countries) provide information on the average *OTE*, *PTE* and *SE* per country for ten consecutive years, from 1991 through 2000. The data in the Tables show that the patterns of the three measures of efficiency are similar when looking at the individual country level. Moreover, the Tables also show that for all countries in the sample the measures fluctuate across countries during 1991-2000. In general, however, for most countries the efficiency measures are higher at the beginning of the period as compared to the value of these measures at the end of the period. This finding may be partly due to the fact that the number of banks per country for which data are available at the beginning of the period is relatively low. Thus, the figures for the efficiency measures may suffer from a sample bias in the early 1990s. When looking at trends for individual countries Tables 4A and 4B indicate that for Argentina, Brazil, Indonesia,

⁵ Laeven (2003) provides financial liberalization data for 13 countries. In the analysis we have left out Chile, Malaysia and Taiwan, because Bankscope provides data for only a few banks from these three

Pakistan and Thailand efficiency seems to go down during most of the period, whereas for India and Korea efficiency goes up from the mid-1990s, after an initial decline during the first years of the decade. For the Philippines and Peru no clear trend is observed.

Recall that overall technical efficiency (*OTE*) is affected by both managerial practices, i.e. pure technical efficiency (*PTE*), as well as by the size of banks, i.e. scale efficiency (*SE*). When looking at the Table it is clear that for all countries in the sample *OTE* is lower than *PTE* during the period 1991-2000.⁶ This result implies that the overall technical efficiency is mainly caused by the pure technical efficiency of banks in the countries in our sample. When grouping the data for countries into two regions, i.e. Latin America and Asia, it appears that Asian banks have lower overall technical efficiency than banks in Latin America. The average *OTE* of Latin American banks over the period 1991-2000 is 0.75; for Asian banks this is 0.71. However, these averages are not significantly different from each other.⁷ The averages for *PTE* are almost the same.⁸

<Insert Tables 4A and 4B here>

The empirical analysis in this paper focuses on relating our measures of bank efficiency to our measure of financial liberalization (*LIBER*). A positive relationship between *LIBER* and *OTE*, *PTE* and/or *SE* would indicate that financial liberalization policies carried out in emerging economies during 1991-2000 have a positive impact on bank efficiency, as is hypothesized in section 2. The econometric framework uses a

countries during the period 1991-1996.

⁶ Except for Pakistan in 2000; in this case *OTE* and *PTE* are equal.

⁷ T-value is 1.37.

⁸ The average *PTE* of Latin American banks over the period 1991-2000 is 0.829; for Asian banks this is 0.813.

balanced panel data set based upon ten years of observations for ten emerging economies. Thus, our total sample consists of 100 observations. We apply fixed effects estimations. The econometric specification of the model is as follows:

$$Y_{eit} = \alpha_i + \beta LIBER_{it} + \gamma X_{it} + \varepsilon_{it} \tag{1}.$$

In this model, Y is a vector of efficiency measures for country i at time t ; α_i captures the country-specific effects; $LIBER$ is the measure of financial liberalization for country i at time t ; and X is vector of control variables, including bank specific features and the macroeconomic environment for country i at time t . We have selected control variables that have been found relevant in other studies on bank efficiency. We have included a measure of the density of demand, GDP growth, and inflation rate as our macroeconomic variables.

The density of demand (DD) is defined as the ratio of total value of deposits per square kilometre. In the literature it is hypothesized that banks operating in a market with lower density of demand suffer from higher expenses in making loans and gathering deposits through their branches. Therefore, bank efficiency and demand density are positively correlated (Dietsch *et al.*, 2000; Lozano-Vivas *et al.*, 2001 and 2002). The annual growth rate of GDP (YG) serves as a proxy for measuring the overall level of development, which may influence the quality and the skill levels of institutions (Claessens *et al.*, 2001; Lensink and Hermes, 2004). Therefore, bank efficiency is assumed to be positively correlated with overall economic development. The annual inflation rate (INF) is included to capture potential inefficiencies due to price (high interest margin) and non-price (excessive branches) behaviour of banks (Grigorian and Manole, 2002). Thus, annual inflation and bank efficiency are expected

to be correlated negatively. The macroeconomic data were obtained from World Development Indicators provided by the World Bank.

The bank-specific control variables in our model are the capital (equity) to asset ratio (EQ), the return on equity ratio (ROE) and the total loans to deposits ratio (LTD). The relationship between EQ and bank efficiency can be positive or negative. Berger and De Young (1997) suggest that a higher capital to asset ratio indicates lower bad loan problems, which reduces the additional costs to recover these bad loans. Dietsch *et al.* (2000) and Lozano-Vivas *et al.* (2001) argue that a lower capital to asset ratio is associated with lower bank efficiency, since it involves higher risk taking. Moreover higher leverage ratios are also more costly to the bank. Higher levels of EQ are therefore associated with higher bank efficiency. In contrast, low capital ratios may encourage banks to undertake risky business by investing in highly profitable projects. This may help banks obtain higher efficiency at least in the short term (Lozano-Vivas *et al.*, 2002). The return on equity ratio (ROE) is used as a proxy of competitiveness in the banking industry. Assuming a competitive market environment, this ratio is expected to have a positive impact on efficiency (see, *e.g.*, Lozano-Vivas *et al.*, 2001 and 2002). Finally, the loan to deposit ratio (LTD) is a measure of the efficiency of banks in terms of the extent to which they are able to transform deposits into loans. The higher this ratio, the more efficient the process of financial intermediation provided by the bank (Dietsch *et al.*, 2000 and Fries *et al.*, 2005). Thus, higher levels of LTD are associated with higher levels of bank efficiency.

Table 5 shows the correlation matrix of the independent variables in the model. The matrix shows that in general correlation between the exogenous variables is low (except perhaps for the correlation between $LIBER$ and EQ), which means that multicollinearity problems are not severe or non-existent. Table 6 provides descriptive

statistics of all endogenous and exogenous variables used in the empirical investigation. The Table shows that some of the variables are not normally distributed, especially *INF*, *LTD* and *ROE*.

<Insert Table 5 here>

<Insert Table 6 here>

5. EMPIRICAL RESULTS

The empirical model specified in equation is estimated using the panel least square fixed effects methodology. We use the fixed effects model, since we focus on a limited of number of countries, for which we want to assess country-specific differences with respect to the relationship between financial liberalization and bank efficiency (Hsiao, 1986; Baltagi, 1995). The empirical model is tested for each of the three measures of efficiency, i.e. *OTE*, *PTE* and *SE*. The research strategy follows the specific-to-general approach (Brooks, 2002). We start by investigating the relationship between the financial liberalization variable (*LIBER*) and efficiency. Next, we include the control variables one by one to test the stability of the main independent variable *LIBER*. We adjust for cross-section heteroskedasticity to make robust estimates of standard errors by using White cross-section tests since the cross-sectional units (countries in this case) may have different sizes and characteristics, which may lead different variations in regression disturbances (Baltagi, 1995). The results of the estimations are presented in Tables 7-9.

Column [1] in Table 7 shows the results of the relationship between *OTE* (overall technical efficiency) and *LIBER*. The result shows that the coefficient of

LIBER is positive and significant at the 1 per cent level. This result supports the hypothesis that financial liberalization leads to improvements of overall technical efficiency of banks in the countries in our dataset. Next, we add the bank-specific and country-specific control variables (columns [2]-[7]). Adding these control variables does not change the results for *LIBER*: the coefficient remains to be significant and increases only slightly from 0.077 in Column [1] to 0.088 in Column [7]. The majority of the control variables are statistically significant and their coefficients do not change much in the different specifications of the model. Moreover, the explanatory power of the different models is rather high with values of the adjusted R-squared ranging from 64 to 67 per cent.

<Insert Table 7 here>

Two of the three bank-specific variables are statistically significant. The capital to asset ratio (*EQ*) has a negative coefficient that is significant at the 1 per cent level, supporting the idea that low capital ratios encourage banks to undertake risky business by investing in highly profitable projects. The return on equity ratio (*ROE*) is positive and statistically significant at the 1 per cent level, which confirms our hypothesis concerning the relationship between market competition and bank efficiency. The loan to deposit ratio (*LTD*) is not statistically significant.

Two of the three country-specific variables are statistically significant. The coefficient of the density of demand (*DD*) variable is negative and statistically significant at the 1 per cent level. This is opposite to what we expected based on the theory that banks operating in markets with higher density of demand incur lower costs of mobilizing deposits and granting loans, resulting in higher bank efficiency. We have

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no clear explanation for this unexpected result.⁹ The inflation rate (*INF*), used as a proxy for macroeconomic instability, is not statistically significant. Finally, the GDP growth rate (*YG*), a proxy for the overall level of economic development of a country is positive and statistically significant at the 1 per cent, which is in line with what we expected. This result indicates that banks operating in countries with higher GDP growth are more efficient due to the corresponding quality and skills of financial institutions.

Next, we use the pure technical efficiency (*PTE*) as the dependent variable. The results of the empirical analysis remain to be very similar to the ones we get when we use overall technical efficiency (*OTE*) as the dependent variable. The results for *PTE* are presented in Table 8. Again, we find that the coefficient of *LIBER* is positive and significant at the 1 per cent level, which supports the hypothesis that financial liberalization leads to improvements of bank efficiency. Adding control variables does not change the results for *LIBER*: the coefficient remains to be significant and increases only slightly from 0.047 in Column [1] to 0.054 in Column [7]. Again, the majority of the control variables are statistically significant and their coefficients do not change much in the different specifications of the model. The only major difference with the results in table 7 is that when we use *PTE* as dependent variable *YG* is no longer statistically significant.

<Insert Table 8 here>

Finally, we use scale efficiency (*SE*) as the dependent variable. The results, presented in Table 9, show that the coefficient of *LIBER* is positive and significant at

⁹ Fries and Taci (2005) also find a negative coefficient for *DD*. In their study the coefficient is not statistically significant, however.

the 1 per cent level. Again, therefore, we find support for our hypothesis that financial liberalization leads to improvements of bank efficiency. This result is not changed when adding control variables does not change the results for *LIBER*: the coefficient remains to be significant and increases only slightly from 0.046 in Column [1] to 0.053 in Column [7]. This time, however, only two control variables (*ROE* and *YG*) are found to be statistically significant with the right sign.

<Insert Table 9 here>

6. SUMMARY AND CONCLUSIONS

Using data for a sample of over 4,000 bank-year observations from ten emerging economies for the period 1991-2000, we have investigated the impact of financial liberalization on bank efficiency. We have used the DEA approach to calculate three different bank efficiency measures at the individual bank level. Next, the individual bank efficiency data have been aggregated at the country level, providing three different bank efficiency measures per country per year. These measures have been used to investigate the relationship between financial liberalization and bank efficiency, using a panel least square fixed-effects model.

Our paper contributes to the ongoing debate on the relationship between financial liberalization and bank efficiency in the sense that we present one of the very few multi-country panel data regression analyses. Moreover, contrary to previous studies we explicitly take into account the depth of financial liberalization policies and their effect on bank efficiency. This is possible since we use a unique dataset provided by Laeven (2003) which explicitly measures to what extent governments have liberalized markets.

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Overall, the results from the empirical analysis strongly support the positive impact of financial liberalization programmes on bank efficiency. This result holds across all three measures of bank efficiency and all specifications we have used in testing the relationship.

Future research on this issue should focus on extending the data set in terms of countries and years. Of course, this requires information on financial liberalization programmes in different countries. Such information is currently not available. In addition, further research may apply different methods to analyze the impact of financial liberalization on bank efficiency, such as for example stochastic frontier analysis, to see whether and to what extent the results are sensitive to the methodology used.

REFERENCES

- Aly, H.Y., Grabowski, R., 1990, "Technical, scale, and allocative efficiencies in U.S. banking: an empirical investigation", *The Review of Economics and Statistics*, 72 (2), 211-219.
- Ataullah, A., Cockerill, T., Le, H., 2004, "Financial liberalization and bank efficiency: A comparative analysis of India and Pakistan", *Applied Economics*, 36 (17), 1915-1924.
- Ataullah, A., Le, H., 2006, "Economic reforms and bank efficiency in developing countries: the case of the Indian banking industry", *Applied Financial Economics*, 16 (9), 653-663.
- Baltagi, B.H., 1995, *Econometric analysis of panel data*, Chichester: Wiley & Sons.
- Banker, R.D., Charnes, A., Cooper, W.W., 1984, "Some models for estimating technical and scale inefficiencies in data envelopment analysis," *Management Science*, 30 (9), 1078-1092.
- Barajas, A., Steiner, R., 2000, "The impact of liberalization and foreign investment in Colombia's financial sector", *Journal of Development Economics*, 63 (1), 157-197.
- Berg, S.A., Førsund, F.R., Hjalmarsson, L., Suominen, M., 1993, "Banking efficiency in the Nordic countries", *Journal of Banking and Finance*, 17 (2-2), 371-388.
- Berger, A.N., De Young, R., 1997, "Problem loans and cost efficiency in commercial banks", *Journal of Banking and Finance*, 21 (6), 849-870.
- Berger, A.N., Humphrey, D.B., 1997, "Efficiency of financial institutions: International survey and directions for future research", *European Journal of Operational Research*, 98 (2), 175-212.

- Bhattacharyya, A., Lovell, C.A.K., Sahay, P., 1997, "The impact of liberalization on the productive efficiency of Indian commercial banks", *European Journal of Operational Research*, 98 (2), 332-345.
- Brooks, C., 2002, *Introductory econometrics for finance*, Cambridge: Cambridge University Press.
- Claessens, S., Demirguc-Kunt, A., Huizinga, H., 2001, "How does foreign entry affect domestic banking markets?" *Journal of Banking and Finance*, 25 (5), 891-912.
- Coelli, T., Prasada Rao, D.S., Battese, G.E., 1999, *An introduction to efficiency and productivity analysis*, 2nd ed., Dordrecht: Kluwer Academic Publishers.
- Debreu, G., 1951, "The coefficient of resource utilization", *Econometrica*, 19 (3), 273-292.
- Denizer, C.A., Dinç, M., Tarimcilar, M., 2000, "Financial liberalization and banking efficiency: Evidence from Turkey", *Journal of Productivity Analysis*, 27 (3), 177-195.
- Dietsch, M., Lozano-Vivas, A., 2000, "How the environment determines banking efficiency: A comparison between French and Spanish banks", *Journal of Banking and Finance*, 24 (6), 985-1005.
- Farrell, M.J., 1957, "The measurement of productive efficiency", *Journal of the Royal Statistical Society*, 120 (3), 253-290.
- Favero, C.A., Papi, L., 1995, "Technical efficiency and scale efficiency in the Italian banking sector: A non-parametric approach", *Applied Economics*, 27 (4), 385-396.
- Ferrier, G.D., Lovell, C.A.K., 1990, "Measuring cost efficiency in banking: Econometric and linear programming evidence", *Journal of Econometrics*, 46 (1), 229-245.

- Fries, S., Taci, A., 2005, "Cost efficiency of banks in transition: Evidence from 289 banks in 15 post-communist countries", *Journal of Banking and Finance*, 29 (1), 82-110.
- Gilbert, R.A., Wilson, P.W., 1998, "Effects of deregulation on the productivity of Korean banks", *Journal of Economics and Business*, 50 (2), 133-156.
- Grifell-Tatje, E., Lovell, C., 1996, "Deregulation and productivity decline: The case of Spanish savings banks", *European Economic Review*, 40 (6), 1281-1303.
- Grigorian, D.A., Manole, V., 2002, *Determinants of commercial bank performance in transition: An application of Data Envelopment Analysis*, Policy research working papers, 2850, Washington DC: The World Bank.
- Hao, J., Hunter, W.C., Wang, W.K., 2001, "Deregulation and efficiency: the case of private Korean banks", *Journal of Economics and Business*, 53 (2/3), 237-255.
- Hardy, D.C., Patti, E.B., 2001, *Bank reform and bank efficiency in Pakistan*, International Monetary Fund, Working Paper, WP/01/138, Washington DC: IMF.
- Hermes, N., Lensink, R., 2008, "Does financial liberalization influence saving, investment and economic growth? Evidence from 25 emerging market economies, 1973-1996", in: B. Guha-Khasnobis and G. Mavrotas (eds.), *Financial development, institutions, growth and poverty reduction*, Basingstoke: Palgrave Macmillan, forthcoming.
- Hsiao, C., 1986, *Analysis of panel data*, New York: Cambridge University Press.
- Hunter, W.C. Timme, S.G., 1995, "Core deposits and physical capital: A re-examination of bank-scale economic and efficiency with quasi-fixed inputs", *Journal of Money, Credit and Banking*, 27 (1), 165-186.

- Isik, I., Hassan, M.K., 2003, "Financial deregulation and total factor productivity change: An empirical study of Turkish commercial banks", *Journal of Banking and Finance*, 27 (8), 1455–85.
- King, R., Levine, R., 1993, "Finance and growth: Schumpeter might be right", *Quarterly Journal of Economics*, 108 (3), 717-738.
- Koopmans, T.C., 1951, "Efficient allocation of resources", *Econometrica*, 19 (4), 455-465.
- Kumbhakar, S.C., Lovell, C.A., 2000, *Stochastic frontier analysis*, Cambridge and New York: Cambridge University Press.
- Kumbhakar, S.C., Sarkar, S., 2003, "Deregulation, ownership, and productivity growth in banking industry: Evidence from India", *Journal of Money Credit and Banking*, 35 (3), 403–24.
- Kumbhakar, S.C., Lozano-Vivas, A., 2001, "The effects of deregulation on the performance of financial institutions: The case of Spanish banks", *Journal of Money, Credit and Banking*, 33 (1), 101-121.
- Laeven, L., 2003, "Does financial liberalization reduce financial constraints?" *Financial Management*, 32 (1), 5-35.
- Lensink, R., Hermes, N., 2004, "The short-term effects of foreign bank entry on domestic bank behaviour: Does economic development matter?" *Journal of Banking and Finance*, 28 (3), 553-568.
- Lozano-Vivas, A., Pastor, J.T., Pastor, J.M., 2002, "An efficiency comparison of European banking systems operating under different environmental conditions", *Journal of Productivity Analysis*, 18 (1), 59-77.
- Lozano-Vivas, A., Pastor, J.T., Hasan, I., 2001, "European bank performance beyond country borders: What really matters?" *European Finance Review*, 5 (1), 141-165.

- 1
2
3 Maudos, J., Pastor, J.M., Pereze, F., 2002, "Competition and efficiency in the Spanish
4 banking sector: The importance of specialization", *Applied Financial Economics*,
5
6 12 (7), 505-516.
7
8
9
10 McKinnon, R.I., 1973, *Money and capital in economic development*, Washington, D.C.:
11
12 The Brookings Institution.
13
14
15 Patti, B.E., Hardy, D.C., 2005, "Financial sector liberalization, bank privatization, and
16
17 efficiency: Evidence from Pakistan", *Journal of Banking and Finance*, 29 (8)
18
19 2381-2406.
20
21
22 Shaw, E.S., 1973, *Financial deepening in economic development*, New York: Oxford
23
24 University Press.
25
26
27 Wheelock, D.C., Wilson, D.C., 1995, "Evaluating the efficiency of commercial banks:
28
29 Does our view of what banks do matter?" *Federal Reserve Bank of Saint Louis*
30
31 *Economic Review*, 77 (4), 39-53.
32
33
34 Williams, J., Nguyen, N., 2005, "Financial liberalization, crisis, and restructuring: A
35
36 comparative study of bank performance and bank governance in South East Asia",
37
38 *Journal of Banking and Finance*, 29 (8), 2119-2154.
39
40
41 World Bank, 1989, *World development report 1989*, Washington DC: The World
42
43 Bank.
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Table 1: The Financial Liberalization Index

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Argentina	2	2	4	5	6	6	6	6	6	6
Brazil	3	3	3	4	4	4	5	6	6	6
India	0	0	2	3	3	5	5	5	5	5
Indonesia	4	5	5	5	5	5	6	6	6	6
Korea	2	3	4	4	4	6	6	6	6	6
Mexico	3	4	5	6	6	6	6	6	6	6
Pakistan	0	0	1	2	4	4	5	5	5	5
Peru	2	3	4	4	5	6	6	6	6	6
Philippines	2	2	3	5	5	6	6	6	6	6
Thailand	1	4	4	4	5	5	6	6	6	6

SOURCE: Laeven (2003), Table 2.

NOTE: The financial liberalization index shows the extent to which a country has implemented financial liberalization policies in six different areas in a particular year. These six areas are interest rates, entry barriers, reserve requirements, credit controls, privatization and prudential regulation. For each year and for each policy area Laeven (2003) has evaluated whether there has been significant progress in taking liberalization measures. For each of the six policy areas a dummy is created, which is 0 when no significant progress has been made in a particular year; it is 1 when there has been significant progress. The financial liberalization index for a particular year is the sum of the six dummy variables in that year. Thus the index ranges from 0 to 6.

Table 2: Number of banks per country in the sample, 1991-2000

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total
Argentina	18	27	18	18	12	17	19	67	76	69	341
Brazil	13	23	16	98	105	145	68	144	118	135	865
India	36	53	54	65	67	74	72	71	71	62	625
Indonesia	16	45	64	78	82	81	52	55	60	50	583
Korea	6	17	12	29	33	35	36	27	25	23	243
Mexico	8	10	6	22	34	35	26	43	43	37	264
Pakistan	5	15	9	23	24	29	25	29	28	25	212
Peru	5	16	9	23	26	27	26	29	22	21	204
Philippines	14	20	16	31	36	42	46	43	43	36	327
Thailand	14	27	23	41	45	46	32	37	36	37	338
Total	135	253	227	428	464	531	402	545	522	495	4,002

Table 3: Total assets of sample banks (% of total banking system assets), 1991-2000

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Argentina	0.98	0.96	0.84	0.82	0.88	0.87	0.75	0.79	0.83	0.84
Brazil	1.00	0.97	1.00	0.87	0.86	0.85	0.86	0.84	0.84	0.77
India	0.98	0.98	0.95	0.96	0.96	0.96	0.95	0.95	0.96	0.97
Indonesia	0.23	0.34	0.70	0.80	0.80	0.78	0.74	0.49	0.35	0.37
Korea	0.58	0.70	0.53	0.60	0.61	0.62	0.63	0.69	0.71	0.73
Mexico	0.89	0.87	0.51	1.00	0.81	0.84	0.80	0.70	0.61	0.59
Pakistan	0.95	0.97	1.00	0.83	0.82	0.83	0.83	0.87	0.79	0.72
Peru	1.00	1.00	0.38	0.59	0.64	0.66	0.68	0.76	0.71	0.72
Philippines	0.95	0.96	1.00	1.00	0.70	0.71	0.77	0.74	0.74	0.72
Thailand	1.00	0.89	0.72	0.93	0.92	0.93	0.89	0.89	0.92	0.93

Table 4A: Average bank efficiency per country, Latin America 1991-2000

		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Argentina											
	<i>OTE</i>	0.81	0.75	0.84	0.89	0.81	0.71	0.88	0.50	0.56	0.59
	<i>PTE</i>	0.87	0.81	0.88	0.94	0.90	0.87	0.93	0.70	0.69	0.74
	<i>SE</i>	0.93	0.92	0.96	0.95	0.89	0.82	0.95	0.71	0.82	0.80
Brazil											
	<i>OTE</i>	0.93	0.80	0.79	0.52	0.55	0.42	0.63	0.40	0.49	0.42
	<i>PTE</i>	0.96	0.89	0.83	0.61	0.65	0.62	0.75	0.51	0.63	0.50
	<i>SE</i>	0.97	0.91	0.96	0.87	0.85	0.67	0.84	0.78	0.78	0.84
Mexico											
	<i>OTE</i>	0.88	0.87	0.98	0.75	0.71	0.69	0.77	0.79	0.76	0.72
	<i>PTE</i>	0.91	0.90	1.00	0.82	0.82	0.75	0.86	0.82	0.82	0.77
	<i>SE</i>	0.96	0.97	0.98	0.92	0.87	0.92	0.89	0.97	0.92	0.94
Peru											
	<i>OTE</i>	0.85	0.82	0.97	0.86	0.90	0.89	0.93	0.84	0.85	0.87
	<i>PTE</i>	0.95	0.88	0.98	0.93	0.95	0.96	0.96	0.92	0.92	0.96
	<i>SE</i>	0.90	0.94	0.99	0.93	0.94	0.93	0.97	0.91	0.92	0.91

Table 4B: Average bank efficiency per country, Asia 1991-2000

		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
India											
	<i>OTE</i>	0.66	0.44	0.58	0.55	0.52	0.60	0.67	0.52	0.59	0.67
	<i>PTE</i>	0.75	0.52	0.69	0.70	0.71	0.72	0.75	0.66	0.68	0.73
	<i>SE</i>	0.88	0.85	0.84	0.78	0.73	0.83	0.89	0.79	0.87	0.92
Indonesia											
	<i>OTE</i>	0.80	0.77	0.65	0.72	0.61	0.48	0.68	0.58	0.63	0.60
	<i>PTE</i>	0.85	0.86	0.76	0.82	0.77	0.67	0.83	0.77	0.79	0.79
	<i>SE</i>	0.94	0.89	0.85	0.88	0.79	0.71	0.82	0.75	0.80	0.76
Korea											
	<i>OTE</i>	0.94	0.81	0.92	0.61	0.59	0.66	0.76	0.75	0.77	0.73
	<i>PTE</i>	0.98	0.91	0.97	0.66	0.72	0.75	0.82	0.87	0.84	0.85
	<i>SE</i>	0.97	0.89	0.95	0.92	0.83	0.88	0.93	0.87	0.92	0.86
Pakistan											
	<i>OTE</i>	0.99	0.77	0.87	0.84	0.81	0.73	0.78	0.76	0.71	0.85
	<i>PTE</i>	1.00	0.96	0.98	0.92	0.89	0.88	0.88	0.87	0.80	0.85
	<i>SE</i>	0.99	0.80	0.89	0.92	0.91	0.83	0.88	0.88	0.89	1.00
Philippines											
	<i>OTE</i>	0.84	0.83	0.81	0.69	0.80	0.73	0.67	0.71	0.75	0.70
	<i>PTE</i>	0.94	0.89	0.84	0.79	0.89	0.86	0.80	0.79	0.81	0.81
	<i>SE</i>	0.89	0.94	0.97	0.88	0.91	0.85	0.83	0.90	0.93	0.87
Thailand											
	<i>OTE</i>	0.87	0.80	0.87	0.74	0.74	0.54	0.81	0.60	0.54	0.52
	<i>PTE</i>	0.97	0.87	0.92	0.83	0.81	0.68	0.87	0.73	0.72	0.74
	<i>SE</i>	0.90	0.91	0.94	0.89	0.91	0.79	0.93	0.83	0.75	0.71

Table 5: Correlation matrix for the exogenous variables in the model

	<i>LIBER</i>	<i>DD</i>	<i>YG</i>	<i>INF</i>	<i>EQ</i>	<i>LTD</i>	<i>ROE</i>
<i>LIBER</i>	1						
<i>DD</i>	0.030	1					
<i>YG</i>	-0.229	0.129	1				
<i>INF</i>	-0.259	-0.075	-0.015	1			
<i>EQ</i>	0.505	-0.174	0.012	-0.160	1		
<i>LTD</i>	0.109	-0.037	0.047	-0.026	0.062	1	
<i>ROE</i>	-0.120	-0.081	0.097	-0.017	-0.064	-0.004	1

NOTE: *LIBER* = measure of financial liberalization (for a detailed discussion of this measure, see main text); *DD* = density of demand, defined as the ratio of total value of deposits per square kilometre; *YG* = annual growth rate of GDP; *INF* = annual inflation rate; *EQ* = capital (equity) to asset ratio; *ROE* = return on equity ratio; *LTD* = total loans to deposits ratio.

Table 6: Summary statistics

	Mean	Median	Maximum	Minimum	St Dev	Skewness	Kurtosis	Obs.
<i>OTE</i>	0.726	0.749	0.99	0.398	0.139	-0.378	2.40	100
<i>PTE</i>	0.819	0.827	1	0.503	0.111	-0.633	3.10	100
<i>SE</i>	0.880	0.891	1	0.670	0.071	-0.762	3.13	100
<i>LIBER</i>	0.61	1	1	0	0.490	-0.451	1.20	100
<i>EQ</i>	0.068	0.067	0.191	-0.035	0.043	0.397	2.82	100
<i>DD</i>	729.3	55.4	9079.2	3.0	2096.2	3.21	11.80	100
<i>INF</i>	70.0	8.2	2075.9	-1.2	299.0	5.78	36.67	100
<i>YG</i>	4.3	4.8	12.8	-13.1	4.3	-1.28	6.12	100
<i>LTD</i>	1.64	0.57	87.8	0.04	8.78	9.61	94.74	100
<i>ROE</i>	0.119	0.030	10.97	-1.51	1.14	8.81	84.91	100

NOTE: *OTE* = overall technical efficiency (for a detailed discussion of this measure, see main text); *PTE* = pure technical efficiency (for a detailed discussion of this measure, see main text); *SE* = scale efficiency (for a detailed discussion of this measure, see main text); *LIBER* = measure of financial liberalization (for a detailed discussion of this measure, see main text); *DD* = density of demand, defined as the ratio of total value of deposits per square kilometre; *YG* = annual growth rate of GDP; *INF* = annual inflation rate; *EQ* = capital (equity) to asset ratio; *ROE* = return on equity ratio; *LTD* = total loans to deposits ratio.

Table 7: Panel least square estimations with *OTE* as dependent variable

Variables	[1]	[2]	[3]	[4]	[5]	[6]	[7]
<i>Constant</i>	0.679*** (0.012)	0.731*** (0.018)	0.731*** (0.018)	0.731*** (0.019)	0.757*** (0.026)	0.752*** (0.025)	0.749*** (0.020)
<i>LIBER</i>	0.077*** (0.010)	0.080*** (0.020)	0.080*** (0.020)	0.083*** (0.022)	0.084*** (0.022)	0.084*** (0.021)	0.088*** (0.020)
<i>EQ</i>		-0.798*** (0.233)	-0.800*** (0.233)	-0.842*** (0.265)	-1.007*** (0.338)	-0.960*** (0.318)	-1.130*** (0.274)
<i>LTD</i>			0.0001 (0.0004)	6.25E-05 (0.0004)	4.57E-05 (0.0004)	2.69E-05 (0.0004)	-0.0003 (0.0005)
<i>ROE</i>				0.012*** (0.004)	0.012*** (0.005)	0.012*** (0.005)	0.012*** (0.005)
<i>DD</i>					-2.1E-05*** (6.6E-06)	-2.1E-05*** (6.66E-06)	-2.3E-05*** (6.81E-06)
<i>INF</i>						1.89E-05 (3.87E-05)	1.54E-05 (3.80E-05)
<i>YG</i>							0.003*** (0.001)
<i>R</i> ²	0.706	0.729	0.729	0.736	0.750	0.751	0.756
<i>Adj. R</i> ²	0.636	0.660	0.655	0.661	0.674	0.671	0.674
<i>Obs.</i>	100	100	100	100	100	100	100
<i>F-statistic</i>	10.14	10.60	9.97	9.78	9.89	9.40	9.19

NOTE: *OTE* = overall technical efficiency (for a detailed discussion of this measure, see main text); *LIBER* = measure of financial liberalization (for a detailed discussion of this measure, see main text); *DD* = density of demand, defined as the ratio of total value of deposits per square kilometre; *YG* = annual growth rate of GDP; *INF* = annual inflation rate; *EQ* = capital (equity) to asset ratio; *ROE* = return on equity ratio; *LTD* = total loans to deposits ratio. ***, **, *, Indicates significance at the 1, 5 and 10 percent level, respectively. White cross-section standard errors are presented in parentheses.

Table 8: Panel least square estimations with *PTE* as dependent variable

Variables	[1]	[2]	[3]	[4]	[5]	[6]	[7]
<i>Constant</i>	0.791*** (0.010)	0.842*** (0.015)	0.842*** (0.015)	0.841*** (0.015)	0.867*** (0.016)	0.865*** (0.016)	0.864*** (0.014)
<i>LIBER</i>	0.047*** (0.016)	0.050*** (0.016)	0.049*** (0.016)	0.051*** (0.018)	0.052*** (0.016)	0.0524*** (0.016)	0.0540*** (0.016)
<i>EQ</i>		-0.768*** (0.161)	-0.772*** (0.161)	-0.799*** (0.173)	-0.961*** (0.223)	-0.944*** (0.197)	-1.010*** (0.177)
<i>LTD</i>			0.0002 (0.0004)	0.0002 (0.0003)	0.0002 (0.0003)	0.0002 (0.0003)	0.0001 (0.0003)
<i>ROE</i>				0.008*** (0.003)	0.008** (0.004)	0.008** (0.004)	0.008** (0.004)
<i>DD</i>					-2.0E-05*** (6.1E-06)	-2.1E-05*** (6.2E-06)	-2.1E-05*** (6.06E-06)
<i>INF</i>						6.83E-06 (3.57E-05)	5.48E-06 (3.58E-05)
<i>YG</i>							0.001 (0.001)
<i>R</i> ²	0.681	0.713	0.713	0.719	0.738	0.736	0.740
<i>Adj. R</i> ²	0.605	0.640	0.636	0.638	0.659	0.655	0.652
<i>Obs.</i>	100	100	100	100	100	100	100
<i>F-statistic</i>	8.98	9.80	9.24	8.94	9.33	8.83	8.42

NOTE: *PTE* = pure technical efficiency (for a detailed discussion of this measure, see main text); *LIBER* = measure of financial liberalization (for a detailed discussion of this measure, see main text); *DD* = density of demand, defined as the ratio of total value of deposits per square kilometre; *YG* = annual growth rate of GDP; *INF* = annual inflation rate; *EQ* = capital (equity) to asset ratio; *ROE* = return on equity ratio; *LTD* = total loans to deposits ratio. ***, **, *, Indicates significance at the 1, 5 and 10 percent level, respectively. White cross-section standard errors are presented in parentheses.

Table 9: Panel least square estimations with *SE* as dependent variable

Variables	[1]	[2]	[3]	[4]	[5]	[6]	[7]
<i>Constant</i>	0.851*** (0.013)	0.863*** (0.020)	0.863*** (0.020)	0.863*** (0.020)	0.865*** (0.022)	0.858*** (0.022)	0.856*** (0.020)
<i>LIBER</i>	0.046** (0.021)	0.047** (0.021)	0.047** (0.021)	0.0490** (0.022)	0.049** (0.022)	0.050** (0.021)	0.053** (0.021)
<i>EQ</i>		-0.179 (0.224)	-0.175 (0.225)	-0.198 (0.238)	-0.211 (0.253)	-0.142 (0.253)	-0.273 (0.242)
<i>LTD</i>			-0.0003 (0.0003)	-0.0003 (0.0003)	-0.0003 (0.0003)	-0.0003 (0.0003)	-0.0005 (0.0003)
<i>ROE</i>				0.006* (0.003)	0.007* (0.003)	0.006* (0.003)	0.006* (0.003)
<i>DD</i>					-1.74E-06 (3.09E-06)	-1.85E-06 (3.08E-06)	-3.19E-06 (3.44E-06)
<i>INF</i>						2.80E-05 (1.69E-05)	2.53E-05 (1.59E-05)
<i>YG</i>							0.003*** (0.001)
<i>R</i> ²	0.558	0.562	0.563	0.572	0.572	0.580	0.594
<i>Adj. R</i> ²	0.453	0.451	0.445	0.450	0.443	0.446	0.457
<i>Obs.</i>	100	100	100	100	100	100	100
<i>F-statistic</i>	5.31	5.07	4.79	4.68	4.42	4.32	4.33

NOTE: *SE* = scale efficiency (for a detailed discussion of this measure, see main text); *LIBER* = measure of financial liberalization (for a detailed discussion of this measure, see main text); *DD* = density of demand, defined as the ratio of total value of deposits per square kilometre; *YG* = annual growth rate of GDP; *INF* = annual inflation rate; *EQ* = capital (equity) to asset ratio; *ROE* = return on equity ratio; *LTD* = total loans to deposits ratio. ***, **, *, Indicates significance at the 1, 5 and 10 percent level, respectively. White cross-section standard errors are presented in parentheses.